

AN ACCESS METHOD OF A USER TERMINAL FOR COMBINING A CDMA
SYSTEM AND A WIRELESS LOCAL AREA NET

Technical Field of the Invention

The present invention relates to an access method of a user terminal in a communication system, in particular to an access method of a user terminal for combining a CDMA system and a Wireless Local Area Network (WLAN).

Background of the Invention

Code Division Multiple Access (CDMA) is a common multiple access modulation technique based on the wideband spread spectrum technology. A CDMA2000 1X system is designed to conform to the IS-2000 standard, which represents the first stage in the development of CDMA2000 cellular mobile communication technology and can provide a packet data transmission rate of 153.6Kbps.

The outside of the dashed block in Fig. 1 is the existed function nodes of the CDMA2000 1X system, wherein a plurality of base transceivers (BTS) 11 are used to form wireless coverage areas in cells for the communication of mobile user terminals, with a base station controller (BSC) being able to control each BTS; a packet control function (PCF) node 12 is used to transfer messages between a wireless subsystem and a packet data service node (PDSN) 14. The packet data service node is an interface module by which the CDMA2000 1X user terminal can access to Internet. Between the packet data service node and the PCF node is a standard R-P (Radio-Packet) interface, namely A10/A11 interface, wherein A10 is a data channel and A11 is a control channel. The packet data service node provides access service to a CDMA2000 1X user terminal, and the user terminal can be authenticated, authorized and billed by a visited, a broker, and a home authentication, authorization and accounting servers 19, 17, and 18 via the PDSN.

When the user terminal makes a request for a packet data service, firstly the

request is sent to a home location register (HLR) 20 via a mobile switching center (MSC) 13, and the validity of the user's identity is authenticated in the HLR. If the user's identity is valid, an A8/A9 interface is established between the BSC and the PCF, and then the PCF sends a message to the PDSN to set up an R-P connection between the PCF and the PDSN. Thereafter, a PPP connection is set up between the mobile user terminal and the PDSN. After the PPP connection is successfully set up, if the user terminal is a Simple IP subscriber, the data service can be provided. For a Mobile IP subscriber, the MIP registration is necessary, and upon the successful registration, the mobile IP data service can be provided. When the user terminal accesses to the CDMA2000 1X system, it is necessary to execute a complete PPP negotiation process with the PDSN. The PPP uses asynchronous HDLC framing.

Wireless Local Area Net (WLAN) is a product of combining computer network and wireless communication technologies, which can support the communications between computers by means of the wireless multiple access channels and provide the data transmission rate of up to 54Mbps. WLAN user terminals usually use PPPoE (Point to Point Protocol over Ethernet) dial-up or Web + DHCP (Dynamic Host Configuration Protocol) dial-up.

Compared with the wired network, WLAN has the following advantages: easy installation, flexible use, economy, extensibility, etc. Due to its irreplaceable advantages, WLAN has been rapidly applied to some situations where mobile networking and roaming between networks are needed, especially in places where wiring is difficult and remote data processing is needed. In particular, in some industries such as exhibition, conference, tourist service, financial service, mobile office system, etc., WLAN has great development potential. The characteristics of WLAN are low price, flexible networking, easy installation, supporting wireless data high-speed access, and suitable to be applied in hotspot areas such as airport, hotel, etc.

In the WLAN, the wireless user terminal can access to a fixed telecommunication

network via an access point (AP). The AP provides the wireless access function to the user, including voice and data access services, and performs the conversion between 802.11 and 802.3 protocols. The data packets converted by the AP are Ethernet packets.

However, the authentication and accounting mechanisms provided by the WLAN to the user terminal is limited, only authentication at the physical layer can be provided and the accounting mechanism directed to end users cannot be provided, thus the application requirements at the telecommunication level cannot be met. Moreover, its coverage scope is only limited to hotspot areas, which imposes great limitation upon its wide application.

With the development of CDMA system in recent 20 years, now CDMA2000 1X system has been widely used in commercial, not only its authentication and accounting mechanisms have been developed maturely and perfectly, but also its coverage scope is widespread. However, the capability of a CDMA2000 1X system in providing the high-speed access service to user terminals is limited due to its bandwidth limitation. Therefore, the combination of the two systems can bring into play their respective advantages.

The method by which the WLAN user terminal can access to the CDMA system is a main technical problem in combining the WLAN and the CDMA system. An access method with reasonable functions and easy implementation will bring advantageous conditions for the promotion and application of the combination of the CDMA system and the WLAN.

No relevant published reference has been searched up to now as to how to make the WLAN user terminal access to the CDMA2000 1X network and to combine this access method with the access method of the CDMA2000 1X user terminal to provide a uniform access service for the user terminals of the two networks.

Summary of the Invention

The technical problem to be solved by the present invention is to provide a convenient access method of a user terminal, which can combine a CDMA system and a WLAN.

The system to which the present invention is applied includes the existed function nodes of a CDMA system and the additional function nodes which are added after the CDMA system incorporating the functions of a WLAN, the function nodes comprising: a packet data service node, an authentication, authorization and accounting server; an access point, a wireless access point gateway (APGW), etc.

There is provided with an access method of a user terminal for combining a CDMA system and a WLAN, which uses the CDMA system to authenticate a WLAN user terminal.

Preferably, the method comprises: the WLAN user terminal making an access dial-up to request for accessing to the wireless access point gateway of the WLAN; the wireless access point gateway requesting the packet data service node of the CDMA system to set up a data link for the WLAN user terminal; the CDMA system authenticating the WLAN user terminal requesting for access; and upon the successful authentication of the WLAN user terminal by the CDMA system, setting up the data link for the WLAN user terminal.

Preferably, the step of the WLAN user terminal making an access dial-up further comprises: the WLAN user terminal making a PPPoE dial-up to send a request for access to the wireless access point gateway of the WLAN.

Preferably, the step of the wireless access point gateway requesting the packet data service node of the CDMA system to set up a data link for the WLAN user terminal further comprises: the wireless access point gateway determining whether the WLAN user terminal requesting for access is allowed to access; when the wireless access point gateway allows the WLAN user terminal to access, returning a response to the WLAN user terminal and sending a request for setting up an R-P connection to the packet data service node of the CDMA system.

Preferably, the step of the CDMA system authenticating the WLAN user terminal requesting for access further comprises: the packet data service node of the CDMA system receiving the request for setting up a data link for the WLAN user terminal from the wireless access point gateway of the WLAN and notifying the authentication, authorization and accounting server of the CDMA system to authenticate the WLAN user terminal; the authentication, authorization and accounting server performing authentication according to the information of the WLAN user terminal and notifying the packet data service node of the authentication results.

Preferably, the step of the CDMA system authenticating the WLAN user terminal requesting for access further comprises: the authentication, authorization and accounting server determining whether the WLAN user terminal has the CDMA information based on the information of the WLAN user terminal, if yes, the authentication, authorization and accounting server returning the International Mobile Subscriber Identity (IMSI) of the WLAN user terminal to the packet data service node; the packet data service node receiving the IMSI and determining the WLAN user terminal having the access function of the CDMA2000 1X system, otherwise, determining the user terminal being only a WLAN user terminal.

Preferably, the step of setting up the data link for the WLAN user terminal further comprises: the packet data service node allowing to set up the data link with the WLAN user terminal and sending an R-P connection setup response to the WLAN user terminal; the WLAN user terminal starting to transmit data and the CDMA system billing for the data transmission of the WLAN user terminal.

Preferably, the step of the WLAN user terminal starting to transmit data further comprises: starting to transmit data between the WLAN user terminal and the packet data service node; and the authentication, authorization and accounting server of the CDMA system billing during the data transmission of the WLAN user terminal based on the information of the WLAN user terminal.

Preferably, the WLAN user terminal is only a WLAN user terminal or a

double-mode user terminal having both the functions of the WLAN and the functions of the CDMA system.

Preferably, the packets transmitted between the WLAN user terminal and the wireless access point gateway are PPPoE packets; and the packets transmitted between the wireless access point gateway and the packet data service node are PPP packets encapsulated in a tunnel.

Preferably, a standard R-P interface is used between the wireless access point gateway and the packet data service node.

To sum up, the present invention provides an access method of a mobile user terminal based on the combination of CDMA and WLAN, which combines wide coverage and perfect authentication and accounting mechanisms of the CDMA network with high bandwidth of the WLAN and can manage the access of WLAN user terminals and can provide a basis for unifying the management of the user terminals and switching and roaming between a CDMA network and a WLAN.

Brief Description of the Drawings

Fig. 1 is a schematic diagram showing a network structure combining a CDMA2000 1X system and a WLAN; and

Fig. 2 is a schematic flow chart showing a WLAN user terminal accessing to a CDMA2000 1X network according to the present invention.

Description of the Preferred Embodiments

The present invention will be described below in detail with reference to the accompanying drawings and embodiments.

The system model combining a CDMA system and a WLAN to which the present invention corresponds is shown in Fig. 1. The outside of the dashed block is the existed function nodes of the CDMA2000 1X system, the inside of the dashed block is additional function nodes which are added to the CDMA2000 1X system after the

CDMA2000 1X system incorporating the functions of a WLAN.

As shown in Fig. 1, a plurality of base transceivers (BTS) 11 are used to form wireless coverage areas in cells for the communication of mobile user terminals and a base station controller (BSC) can be able to control each BTS.

A packet control function (PCF) node 12 is used to connect an air interface and a packet data service node (PDSN) 14 and assist to perform the access of a CDMA2000 1X user.

The packet data service node 14 can manage the WLAN user terminals accessed via a wireless access point gateway 15, except for performing the existed functions of the CDMA2000 1X network. It can cooperate with three authentication, authorization and accounting servers 17, 18 and 19 to perform the authentication, authorization and accounting for the WLAN user terminal. It also can transfer the media flow of the WLAN user. The packet data service node only provides the access service to the CDMA2000 1X user terminals originally, while in the present invention, the packet data service node can also process the access of the WLAN user terminals based on the characteristics of the WLAN user terminals.

The broker, home and visited authentication, authorization and accounting servers 17, 18 and 19 can authenticate the CDMA2000 1X or the WLAN user terminal that has made a packet data call to determine the validity of the user terminal and implement the uniform authorization of the CDMA2000 1X user terminal and the WLAN user terminal (i.e., when the CDMA2000 1X user terminal is authenticated, if the user terminal has the access function of the WLAN, the WLAN access feature of the user terminal is returned to the packet data service nodes 14; when the WLAN user terminal is authenticated, if the user terminal has the access function of the CDMA2000 1X system, the IMSI information of the user terminal is returned to the packet data service node 14). They can also bill for the packet data calls. The authentication, authorization and accounting server only provides the authentication, authorization and accounting services to the CDMA data user terminals originally,

while in the present invention, the authentication, authorization and accounting server can also process the authentication, authorization and accounting of the WLAN user terminals and unify the identifiers of both CDMA user terminals and WLAN user terminals, based on the characteristics of the WLAN user terminals.

As a connection device through which the WLAN user terminal can access to the fixed telecommunication network, an access point (AP) 16 can provide the wireless access function to users, including the voice and data access services. It can transform the WLAN signals to the signals transmitted in the wired network and manage the wireless user terminals and dynamically allocate the wireless channels.

The wireless access point gateway (APGW) 15 is used to encapsulate and decapsulate the media flow of the WLAN user terminal according to Layer 3 Tunnel Protocol and send the data of the WLAN user terminal to the packet data service node 14, or transfer the data sent from the packet data service node 14 to the WLAN user terminal.

Other system elements such as a mobile switching center/visit location register 13, a home location register 20, Internet, and a home agent etc. are well known in the art and will not be described here.

Fig. 2 is a schematic flow chart of a WLAN user terminal accessing to a CDMA2000 1X network according to the present invention. Next the steps of this embodiment will be described.

201: The mobile user terminal (the WLAN user terminal) accesses to the WLAN via the access point 16.

202: The mobile user terminal makes the PPPoE dial-up and sends a PPPoE Active Discovery Initialization packet to find a service provider.

203: The wireless access point gateway 15 receives the PPPoE Active Discovery Initialization packet, and if it allows the mobile user terminal to access, it sends a PPPoE Active Discovery Offer packet to the mobile user terminal.

204: The mobile user terminal receives the PPPoE Active Discovery Offer packet

and finds the service provider, and then, it sends a PPPoE Active Discovery Request packet to the wireless access point gateway 15.

205: The wireless access point gateway 15 receives the request and sends an R-P connection setup request to the packet data service node 14 to request to set up an R-P connection between the wireless access point gateway 15 and the packet data service node 14.

206: The packet data service node 14 receives the R-P connection setup request, and if it allows the mobile user terminal to access, it sends an R-P connection setup response to the wireless access point gateway 15.

207: The wireless access point gateway 15 receives the R-P connection setup response from the packet data service node 14, thus the tunnel for the mobile user terminal between the wireless access point gateway 15 and the packet data service node 14 has been successfully set up. Then the wireless access point gateway 15 sends a PPPoE Active Discovery Session-confirmation packet to the mobile user terminal.

208: The mobile user terminal receives the PPPoE Active Discovery Session-confirmation packet, thus the negotiations in the PPPoE discovery stage between the mobile user terminal and the wireless access point gateway 15 are completed. Then the mobile user terminal and the packet data service node 14 enter the PPPoE session stage.

209: The negotiations in the PPPoE session stage succeed, thereby the data can be transmitted between the mobile user terminal and the packet data service node 14 via the wireless access point gateway 15.

To sum up, the present invention proposes the solution for the access method of a WLAN user terminal on the basis of the combination of a CDMA2000 1X system and a WLAN system, so that the WLAN user terminal or a double-mode user terminal of WLAN and CDMA2000 1X can access to the CDMA system over the WLAN system. The standard R-P interface is used between the wireless access point gateway and the packet data service node, similar to the interface between the packet control function

node and the packet data service node, thus the packet data service node can expediently manage both the WLAN user terminals and the CDMA2000 1X user terminals. The packet data service node can identify whether the current user terminal is a user terminal which is handed over with the cooperation of the authentication, authorization and accounting server, and process accordingly, thereby providing the basis for the user terminals to be handed over between the CDMA2000 1X system and the WLAN.

The above method is not only applied to the CDMA2000 1X system, but also applied to the CDMA2000 1x EV-DO and CDMA2000 1x EV-DV systems.

The above tunneling encapsulation of the data packets between the wireless access point gateway and the packet data service node can not only use the Generic Routing Encapsulation (GRE), but also use other tunneling encapsulation technologies such as IP in IP and minimal encapsulation etc.